

REMARKS

The following remarks are submitted in response to the Office Action mailed May 25, 2005, regarding the above-identified U.S. patent application.

Claims 1-5, 11-20, 22-25, 33-37, 42-50, 52-56 and 64 have been rejected under 35 USC §103(a) as unpatentable over GB 2,322,479 A (hereinafter referred to as GB '479) in view of EP 0 272 027 (hereinafter referred to as EP '027). In addition, claims 3-6 and 38-41 have been rejected as unpatentable over the same two references, and further in view of Allen et al. (U.S. Patent No. 5,500,913). However, for the reasons set forth hereinafter, Applicants respectfully submit that all of the above claims (all claims remaining of record in this application) distinguish over the cited references, whether considered separately or in combination.

The present invention is directed to an optical coupling arrangement, and to a method of forming such a coupling, between an optical fiber which is embedded in a composite material and a second optical transmission means which is external to the composite. In particular, the invention allows interfacing two embedded fibers without the necessity of cutting the composite, and without the use of complex manufacturing techniques. Instead, interfaces to fibers can be formed post manufacture, or when the composite is already in use, for example, as an aircraft panel, or a marine platform.

According to a feature of the invention, which is recited in independent claims 1 and 33, an "optical processing means" for optically processing light to or from a first optical transmission means which is embedded within the composite is formed on a discrete micro-substrate, which is also embedded within the composite. As described in the specification at paragraph [0028], optical processing of light to and from the first optical transmission means, such as recited in the claims, enhances a signal at the optical interface, improving the efficiency of the coupling of the optical coupling. In addition, the light from the first transmission means can be manipulated to optimize its extraction from the composite. In particular, as also noted in paragraph [0028], such optical processing by the optical processing means which is embedded in the substrate:

...may comprise steering a light beam. More specifically, the steering step may comprise using a beam splitter or a micro-turning mirror. Also the step of optically processing light may comprise collimating a light beam and the light beam collimating step may comprise using a graded index lens or a graded index fiber. All of these different ways of manipulating the light beam can advantageously configure the interfacing process to optimize transmission characteristics regardless of the desired location of input/output to/from the composite.

The specification of the present application also further states (in paragraph [0075]) that the micro-substrate performs the functions of enabling "the micro-optical component 98 and optical fiber 96 to be aligned and secured together with high precision on the micro-substrate 92... ." Further, the specification at paragraph [0029] states that the micro-substrate

"advantageously provides a secure, strain-relieving connection between the optical processing means and the first optical transmission means." Figure 6a clearly shows the discrete micro-substrate 92, to which both optical components 90 and fiber optic cable 96 are secured, and which is embedded within the composite 94. Moreover, independent claims 1 and 33 recite that the micro-substrate is a separate structural entity, to which the first optical transmission means and the optical processing means are secured. No such micro-substrate and no such optical processing means is disclosed in either of the references.

The Office Action states that the optical transmission material 204 of EP '027 constitutes an optical processing means, and that the mirrored plug 210 constitutes a micro-substrate. However, the optical transmission material 204 of EP '027 does not "process" light in any manner, but merely transmits it. In particular, it does not contain any structure which corresponds to that of the optical processing means recited in independent claims 1 and 33 and described in the specification at paragraph [0028]. Even if the optical transmission material 204 could be considered an optical processing means, it is unclear that it is secured to the mirrored plug 210. Moreover, there is no disclosure in EP '027 of the mirrored plug 210 being secured to the optical fiber 111. In addition, the optical plug 210 of EP '027 is not "embedded within" the circuit board in the sense of the present application. That is, as the phrase "embedded within a composite" is defined expressly in paragraph [0002] of the specification, the term

"embedded within" means that the article is "completely surrounded by the composite" and that the article "can only be accessed by entering the interior of the composite." The latter is not true in the case of plug 210 in EP '027, which, as shown in Figure 2, is exposed at the bottom surface of the circuit board. The portion of the specification of the EP '027, to which the Office Action refers, at column 4, lines 51-54, does not mention embedding in micro-substrate. Thus, there is no disclosure of a separate micro-substrate embedded within a composite to which a first optical transmission means and an optical processing means are secured.

Moreover, even were it assumed, for the sake of argument, that EP '027 discloses the features referred to above, nothing contained in either reference provides any suggestion or motivation to a person skilled in the art to combine the teachings of the two references. That is, EP '027 discloses a method of interconnecting optical devices on a printed circuit board, and thus occupies a different field of technology than that of GB '479, which is directed to the field of interconnections between circuit boards. Both of these references, moreover, are in a field which differs from that of the present invention, which relates to coupling a first optical transmission means embedded within a composite to a second optical transmission means external to the composite. In particular, there is no teaching or suggestion in any of the references for connecting to a second optical transmission means. Accordingly, Applicants respectfully submit

that a skilled person who is knowledgeable regarding the disclosure in EP '027, and who attempts to modify GB '479, would not achieve the present invention for this additional reason.

Accordingly, for the reasons set forth above, Applicants respectfully submit that the present invention as defined in independent claims 1 and 33, and therefore in all the remaining claims of record, is neither anticipated by nor obvious over any of the cited references, either considered separately or collectively.

For the foregoing reasons, the application is considered to be in condition for allowance. If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #038665.50770).

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Respectfully submitted,



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